Attorney Docket No.: OGOSH42USA

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application No.	:	10/566,300	Confirmation No. 2014
Applicant	:	Ryo Suzuki	
371 Filed	:	January 25, 2006	
Art Unit	:	1732	
Examiner	:	Jun Li	
Customer No.	:	00270	
Title	:	TARGET FOR SPUTTERING	

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

This is an Appeal Brief submitted in accordance with 37 CFR §41.37 within two months from the filing of April 1, 2011 of a Notice of Appeal. The appeal is taken from a FINAL rejection issued on January 3, 2011 for the above identified application.

Real Party in Interest

The real party in interest is JX Nippon Mining & Metals Corporation.

The named inventor assigned his rights in the application to Nikko Materials Co., Ltd. via assignment recorded in the U.S. Patent and Trademark Office on December 4, 2006, reel/frame: 018578/0943. A name change document recording a name change from Nikko Materials Co., Ltd. to Nippon Mining & Metals Co., Ltd. was recorded in the U.S. Patent and Trademark Office on December 8, 2006, reel/frame: 018605/0969. More recently, Nippon Mining & Metals Co., Ltd. was merged into Nippon Mining Holdings, Inc. (merger document recorded in the U.S. Patent and Trademark Office on October 8, 2010, reel/frame: 025115/0062) and thereafter, the name of Nippon Mining Holdings, Inc. was changed to JX Nippon Mining & Metals Corporation (name change document recorded in the U.S. Patent and Trademark Office on October 12, 2010, reel/frame: 025123/0358).

Related Appeals and Interferences

There are no known prior or pending related appeals, interferences or judicial proceedings.

Status of Claims

Claims 1 and 4-12 are rejected.

Claims 2 and 3 are canceled.

Appellant appeals the final rejection of claims 1 and 4-12.

Status of Amendments

No amendment has been filed by the Appellant or entered by the Examiner in the above referenced application since the Final Office Action dated January 3, 2011.

Summary of Claimed Subject Matter

Independent claim 1 is directed to a sputtering target (see first paragraph on page 1 of the present application, as filed) that is made of a perovskite oxide represented by the chemical formula of $Ra_{1-x}A_xBO_{3-\alpha}$, wherein "Ra" represents an element selected from the group consisting of Y, Sc and lanthanide elements, "A" represents Ca, Mg, Ba or Sr, "B" represents Mn, and $0<x\leq0.5$. See: page 3, lines 15-21; Example 1 on pages 4 and 5; and Examples 2-11 on pages 6-14 of the present application, as filed. The sputtering target has a relative density of 95% or more, an average crystal grain size of 100μm or less, a resistivity of 10Ωcm or less, and a purity of 3N or more. See page 4, lines 3-7, of the present application, as filed.

Independent claim 11 is directed to a sputtering target (see first paragraph on page 1 of the present application, as filed) comprising a sintered body sputtering target consisting of a perovskite oxide. See page 3, line 22, to page 4, line 5, of the present application, as filed. The perovskite oxide is represented by the chemical formula of $Ra_{1-x}A_xMnO_{3-\alpha}$, wherein "Ra" is an element selected from the group consisting of Sc, Ce, Pr, Nd, Sm, Eu, Gd and Dy, wherein "A" is Ca, Mg, Ba or Sr; and wherein $0<x\leq0.5$. See page 3, lines 15-21, and Examples 3-11 on pages 6-14 of the present application, as filed. The sputtering target has a relative density of 95% or more, an average crystal grain size of 100μm or less, a resistivity of 10Ωcm or less, and a purity of 3N or more. See page 4, lines 3-7, of the present application, as filed.

None of the claims includes a means-plus or step-plus function permitted by 35 USC §112, sixth paragraph.

Grounds of Rejection to be Reviewed on Appeal

Claims 1, 5 and 8-10 stand rejected under 35 USC §103(a) as being obvious in view of Japanese Patent Application Publication No. 09-260139 A of Takeda et al. (hereinafter referred to as "JP '139") in view of a 1992 publication of Bates et al. titled "Synthesis, Air Sintering and Properties of Lanthanum and Yttrium Chromites and Manganites" (hereinafter referred to as "Bates et al.") and in further view of Japanese Patent Application Publication No. 09-316630 A of Watanabe et al. (hereinafter referred to as "JP '630").

Claims 4, 6, 7, 11 and 12 stand rejected under 35 USC §103(a) as being obvious in view of Japanese Patent Application Publication No. 09-260139 A of Takeda et al. (hereinafter referred to as "JP '139") in view of a 1992 publication of Bates et al. titled "Synthesis, Air Sintering and Properties of Lanthanum and Yttrium Chromites and Manganites" (hereinafter referred to as "Bates et al.") in further view of Japanese Patent Application Publication No. 09-316630 A of Watanabe et al. (hereinafter referred to as "JP '630") and still in further view of a 2002 publication of M. Fiebig of the University of Dortmund titled "Phase Transitions of MnO_3 Compounds Revealed by Nonlinear Magnetrooptics".

Argument

I. Claims 1, 5 and 8-10

(a) JP '139 Teaches Away from the Present Invention and/or Modifying JP '139 as Needed to Make the Rejection would Destroy the Intent, Purpose or Function of the Invention of JP '139

The rejection of claims 1, 5 and 8-10 is made under 35 USC §103(a) obviousness. Accordingly, it is proper to argue to such an obviousness rejection that the primary reference, in this case JP '139, teaches away from the subject matter required by independent claim 1 of the present application and that the modification of JP '139 needed to make the rejection destroys the intent, purpose or function of the invention disclosed in JP '139.

"Teaching away" is the antithesis of the art suggesting that the person of ordinary skill in the art go in the claimed direction. Essentially, "teaching away" is a per se demonstration of lack of obviousness. Also, when a §103 rejection is based upon a modification of a reference that destroys the intent, purpose or function of the invention disclosed in the reference, such a proposed modification is not proper and a *prima facie* case of obviousness cannot be properly made.

The Abstract of JP '139 states, as follows:

> "An oxide which has a Perovskite structure $La_{1-x}A_xMnO_3$ ... whose main elements are La and Mn and **which conforms an inequality: Mn/(La+A) < 1** and which is expressed, for instance, by a formula: $La_{1-x}A_x$**Mn_y**O_z (**wherein $0.7 \leq y < 1.0$)**".

Independent claim 1 of JP '139 states, as follows:

> "... perovskite structure $La_{1-x}A_xMnO_z$ ... characterized by composition ratios of Mn and (La+A) being **Mn/(La+A) < 1**".

Independent claim 5 of JP '139 states, as follows:

> "A general formula $La_{1-x}A_xMn_yO_z$ … $0.7<y<1.0$".

Paragraph No. 0004 of JP '139 states, as follows:

> "… perovskite structure $La_{1-x}A_xMnO_z$ … composition ratios of Mn and (La+A) are **<u>Mn/(La+A) < 1</u>**."

Paragraph No. 0005 of JP '139 states, as follows:

> "General formula: $La_{1-x}A_xMn_yO_z$ (however, $\mathbf{0.7 \leq y < 1.0}$)".

Paragraph No. 0009 of JP '139 states, as follows:

> "General formula: $La_{1-x}A_xMn_yO_z$ … $\mathbf{0.7 \leq y < 1.0}$".

Accordingly, the Abstract, claims 1 and 5, and Paragraph Nos. 0004, 0005 and 0009 of JP '139 each clearly requires that Mn/(La +A) **<u>must not equal</u>** 1. This is not a matter of being a preferred embodiment of JP '139; rather, this is a clear and precisely stated and defined requirement of JP '139. Thus, JP '139 clearly directs one of ordinary skill in the art that the main elements must conform an inequality in which Mn/(La + A) is less than one.

JP '139 provides a teaching to one of ordinary skill in the art that if the composition ratio of Mn/(La+A) of its disclosed composition (La-A-Mn-O or Y-A-Mn-O) is 1.0 or more, **<u>magnetic resistance will undesirably deteriorate</u>**. See Paragraph No. 0010 of JP '139. Thus, JP '139 requires the use of "y" in Mn_y of its composition being less than 1.0 because otherwise magnetic resistance will be too small for the intended purpose and use of the device of JP '139. Thus, one

of ordinary skill in the art learns from this that the composition ratio of Mn/(La+A) must be less than 1.0 to obtain acceptable magnetic resistance.

In contrast, claim 1 of the present application requires $Ra_{1-x}A_xMnO_{3-\alpha}$. From this required formula, it is clear that Mn/(Ra + A) **must be equal to one**. Thus, JP '139 requires the **opposite** to that required by claim 1 of the present application. In fact, JP '139 teaches away from the composition ratio of Mn/(La+A) being equal to 1 based on its statements concerning undesirable deterioration of magnetic resistance. In addition, if the composition ratio of Mn/(La+A) is modified to equal 1, this would clearly destroy the intent, purpose and function of the composition clearly and explicitly required by JP '139.

For these reasons, Appellant respectfully submits that the above stated rejection is in error because JP '139 teaches away from the invention required by claim 1 of the present application and because modifying JP '139 to read on claim 1 of the present application would not be obvious since this would necessarily require that the stated intent, purpose and function of the invention of JP '139 be destroyed (i.e. permit magnetic resistance to undesirably deteriorate). Accordingly, Appellant respectfully submits that it would not be obvious for one of ordinary skill in the art to modify JP '139 as needed to make the above referenced rejection.

In the FINAL Office Action dated January 3, 2011, it is stated that "JP '139 further discloses $La_{1-x}A_xMnO_3$ with no deficit of Mn (meaning y ratio =1) is well known in the art with a magnetic resistance ([0006]) thus one of ordinary skill in the art would have been obvious to adopt such well known compound for forming a sputtering target." Appellants submit that this reasoning is in error. This rejection is based on §103(a), not §102, and one of ordinary skill in the art would clearly follow the explicit teachings of JP '139. Following the teachings of JP

‘139, one of ordinary skill in the art would be provided with no common sense reason for avoiding or modifying the requirement that the Mn/(Ra + A) ratio (y) be less than 1.0 because JP ‘139 teaches that **magnetic resistance will undesirably deteriorate** if y=1. Thus, it is still true that JP ‘139 teaches away from y=1 and that using y=1 will destroy the intent, purpose and function of the invention taught by JP ‘139 regardless of the composition disclosed as undesirable in Paragraph No. 0006 of JP ‘139. The clear and undeniable impression left on one of ordinary skill in the art following the teachings of JP ‘139 is to avoid y=1. Thus, using y=1 would not be obvious to one of ordinary skill in the art based on the teachings of JP ‘139.

Finally, claim 2 of JP ‘139 contains a typographical error that would be clear to one of ordinary skill in the art as a typographical error. Basic patent law dictates that dependent claim 2 of JP ‘139 includes all the limitations of its base claim and any intervening claim (claim 1 of JP ‘139). Independent claim 1 of JP ‘139 clearly requires **Mn/(La+A) < 1**. Thus, claim 1 of JP ‘139 has already limited “y” to be less than 1 based on its requirement that Mn/(La + A) is less than one. Any contradictory interpretation of the subject matter of claim 2 of JP ‘139 would not be obvious.

For the reason discussed above, Appellant respectfully submits that it is an error to conclude that claims 1, 5 and 8-10 would be obvious to one of ordinary skill in the art with respect to the teachings of JP ‘139 in view of Bates et al. and JP ‘630.

(b) It would not be Obvious to Increase the Density of the Target of JP ‘139

Claim 1 of the present application is directed to a sintered body sputtering target made of a specified perovskite oxide ceramic material having high density and low electrical resistance.

More specifically, the sputtering target required by claim 1 must have a relative density of 95% or more and a resistivity of 10Ωcm or less. Dependent claims 8 and 9 of the present application further limit these values to extremes of relative density of 98.4% or more and resistivity of 2Ωcm or less.

At the time the present invention was made, a sputtering target of the claimed perovskite oxide ceramic material and of a high density for depositing a thin film via a sputtering process did not exist and was not known by one of ordinary skill in the art. (See page 1, lines 26-28, of the present application, as filed.) When a conventional perovskite oxide ceramic material of the claimed composition was used as a sputtering target, its density and strength were low and there were problems with fractures and cracks occurring during target manufacture, transfer of the target, and sputtering operations. (See page 2, lines 1-5, of the present application, as filed.) Further, a low density sputtering target provides problems in that the unwanted generation of particles increase during the sputtering deposition process thereby deteriorating the quality of the thin films produced and increasing the amount of defective products. (See page 2, lines 1-5, of the present application, as filed.) As best stated on page 2, lines 8-10, of the present application, as filed: "Therefore the improvement of density in this kind of ceramic material target existed as an extremely formidable challenge."

However, based on the inventor's significant inventive contribution, the present invention provides a sputtering target that inhibits the occurrence of fractures and cracks and inhibits the generation of particles during sputtering. Thus, the present invention greatly improves yield with respect to manufacture and use of the sputtering target and greatly improves the quality of the film deposited via sputtering and reduces the generation of defective products.

In the FINAL Office Action dated January 3, 2011, it is readily acknowledged that JP '139 is "silent about the specific recited resistivity and relative density, and purity." Thus, the improvement with respect to density of the composition required by the claims of the present application, which is difficult to sinter, is not disclosed, taught or suggested by JP '139, nor is a there a motivation or common sense reason for such an improvement provided by JP '139.

According to the present invention, it is extremely important to improve (i.e., increase) the density of a perovskite oxide ceramic material sputtering target, and, if the density is low, such a sputtering target will likely crack or, in certain cases, break. In addition, there is a problem in that the undesirable generation of particles will increase during the sputtering deposition process, and the quality of the thin film produced will deteriorate. The sputtering target of the present invention having a relative density of 95% or 98.4% or higher is able to overcome all of the foregoing problems. As stated above, this is a sputtering target that could not be obtained conventionally.

Paragraph No. 0018 of JP '139 states that the "thin film was produced with the laser ablation method as shown in drawing 1." Thus, JP '139 provides a disclosure of a laser ablation target employed in a deposition method and provides no reason for giving consideration to improving density.

Laser ablation and DC or RF sputtering processes are different technologies that employ completely different methods of adhering target material to a substrate. In general, laser ablation technology relates to rapidly heating and instantaneously vaporizing target material with a laser so as to adhere such target material to an opposite substrate. In contrast, direct current (DC) or radio frequency (RF) sputtering technology relates to a process including ionizing argon in thin

gas (argon gas), colliding the created argon ions with the target, using the collision energy to discharge the target material, and adhering to a substrate such target material that reaches the substrate.

A sputtering target must be free of fractures and have a uniform structure to enable target material to uniformly adhere on a substrate. Fractures in the body of the sputtering target will cause the generation of micro-arcing during the sputtering process and the generation of particles that are undesirable. Thus, the sputtering target must have a dense structure so cracks will not occur during the sputtering process. Independent claim 1 of the present application requires the "sputtering target" to have a relative density of 95% or more.

In contrast, the density of the laser ablation target disclosed by JP '139 for use in a laser ablation process (see Paragraph No. 0018 and FIG. 1 of JP '139) will not in any way affect the quality of the thin film to be deposited on the substrate during a laser ablation process. It will suffice as long as energy that is capable of instantaneously vaporizing the target material can be applied. In fact, one of ordinary skill in the art is aware that a lower density is preferred so that the laser ablation target can easily vaporize.

Accordingly, Appellant respectfully submits that it would not be obvious for one of ordinary skill in the art to modify the laser ablation target disclosed by JP '139 according to Bates, JP '630, or any other reference, since this would destroy the intent, purpose and function of the target of JP '139. Here, JP '139 discloses a laser ablation target in which lower target densities are preferred so that the target material can be more easily vaporized with a laser. Making the laser ablation target dense defeats this purpose and makes the target more difficult to vaporize. Of course, increasing the relative density to extremely high values of 95% or more or

98.4% or more would certainly be avoided by one of ordinary skill in the art producing a laser ablation target.

For at least this additional reason, Appellant respectfully submits that it is an error to conclude that claims 1, 5 and 8-10 would be obvious to one of ordinary skill in the art with respect to the teachings of JP '139 in view of Bates et al. and JP '630.

(c) JP '139 Modified by the Processing Conditions Taught by Bates et al. would Not Provide the Required Combination

Claim 1 of the present application is directed to a sintered body sputtering target made of a specified perovskite oxide ceramic material having high density and low electrical resistance. More specifically, the sputtering target required by claim 1 must have a relative density of 95% or more, a resistivity of 10Ωcm or less, an average crystal grain size of 100μm or less, and a purity of 3N or more. Dependent claims 8 and 9 further limit these values to a relative density of 98.4% or more and a resistivity of 2Ωcm or less.

In the FINAL Office Action dated January 3, 2011, it is readily acknowledged that JP '139 is "silent about the specific recited resistivity and relative density, and purity."

Bates et al. disclose a relative density for compositions of La-Sr-Cr-O and Y-Ca-Cr-O (see Section 3 "Air-Sintering of Chromites" on pages 237-240). However, only "chromites" are discussed in this section, and absolutely no information is disclosed with respect to the relative density of "manganites". The only discussion of "manganites" by Bates et al. is in Section 4, "Electrical Transport and Thermal Properties", pages 240-241. Also, in the Abstract of Bates et al., the only reference to "manganites" is as follows:

> "The electrical conductivity and thermal expansion also increase with increasing alkaline-earth substitution for the lanthanum or yttrium chromites and manganites. In addition, the electrical, thermal and structural properties of these perovskite materials are also influenced by the synthesis and processing conditions as well as by thermal cycling and heat treatment in air."

Appellant respectfully submits that it is an error to interpret the above recited disclosure of Bates et al. as providing one of ordinary skill in the art with any meaningful teaching concerning the relative density of manganite sputtering targets.

In claim 1 of the present application, the upper limit for the average crystal grain size of the claimed sintered body sputtering target is stated as 100μm. The average crystal grain size of the Examples of sintered body sputtering targets disclosed in the present application, as filed, range from 7 to 67μm. The claims of the present application also require a sintered body sputtering target having a resistivity of 10Ωcm or less (claim 8 of the present application further limits this requirement to 2Ωcm or less).

If the average grain size of the sintered body sputtering target is too small, such as less than about 1μm, the volume of grain boundaries which have high resistance increases and the resistivity of the sintered body as a whole will necessarily become greater than 10Ωcm. Accordingly, assuming Bates et al. discloses an average grain size of 1 to 100nm as stated in the FINAL Office Action dated January 3, 2011 and one of ordinary skill in the art adopts the processing conditions of Bates et al. to make the target of JP '139 as required in the FINAL Office Action for the rejection, this range (1 to 100nm) will take the target outside and above the resistivity (10Ωcm or less) required by claim 1 of the present application. For example, a target of the composition required by the claims of the present application having an average crystal grain size of 1 to 100nm will <u>not</u> have resistivity of 10Ωcm or less.

Thus, a material of JP '139 produced by the processing conditions of Bates et al. would clearly fail to possess the combination of limitations required by the present application including the composition, the relative density, the average crystal grain size, and resistivity and it would not be obvious for one of ordinary skill in the art to simultaneously achieve all of these requirements at the time the present invention was made even if the processing conditions taught by Bates et al. are used to produce the target material of JP '139.

For at least this additional reason, Appellant respectfully submits that it is an error to conclude that claims 1, 5 and 8-10 would be obvious to one of ordinary skill in the art with respect to the teachings of JP '139 in view of Bates et al. and JP '630.

(d) JP '630 is Non-analogous Art Relative to JP '139

The teachings of JP '630 is non-analogous to the teachings of JP '139, and Appellant respectfully submits that it would not be obvious for one of skill in the art using routine skill and knowledge to apply any teaching of JP '630 to that of JP '139.

In the FINAL Office Action dated January 3, 2011, it is stated that "with respect to the recited density and purity, Wantanabe [JP '630] teaches a sputtering target can be made with a relative density of 95-99%". However, the composition of the sputtering target of JP '630 is entirely different to that of JP '139.

JP '630 discloses a BaSrTi oxide based sputtering target for forming a dielectric thin film. This sputtering target and thin film are entirely different in nature, property, function and purpose relative to the composition required by JP '139 and those of ordinary skill in the art would understand that the attributes of these materials would be considerably different.

Moreover, one of ordinary skill in the art would be aware that the sinter-ability of materials differs depending upon their compositional components and that different materials cannot be manufactured under the same conditions with the same results expected.

One of ordinary skill in the art learns nothing relevant to the composition required by the claims of the present application from the disclosure of JP '630 because JP '630 provides absolutely no teachings with respect to a sputtering target made of a composition having extremely inferior sinter-ability as with the composition required by the claims of the present application. Thus, JP '630 neither addresses the problem addressed by the present invention nor offers any assistance in overcoming such a problem. In this respect, JP '630 is non-analogous to the present invention.

For at least this additional reason, Appellant respectfully submits that it is an error to conclude that claims 1, 5 and 8-10 would be obvious to one of ordinary skill in the art with respect to the teachings of JP '139 in view of Bates et al. and further in view of JP '630.

II. Claims 4, 6, 7, 11 and 12

Appellant respectfully submits that claims 4, 6, 7, 11 and 12 are patentable over JP '139 in view of Bates et al. further in view of JP '630 and still further in view of Fiebig for the same reasons stated above that claims 1, 5 and 8-10 are patentable and non-obvious over JP '139 in view of Bates et al. further in view of JP '630. See arguments provided above which also apply to the rejection of claims 4, 6, 7, 11 and 12.

The Fiebig (Dortmund) publication fails to provide any disclosure relative to a sintered compact sputtering target and the relative density thereof. Thus, Fiebig fails to disclose any

claimed feature of the present invention and certainly fails to disclose a sputtering target of the claimed composition meeting the relative density requirement of the claims.

Still further, it is concluded in the FINAL Office Action dated January 3, 2011 that "Bates already teaches substitution of A site element of rare earth elements such as La and Y by alkaline earth element such as Sr and Ca." Applicant respectfully disagrees that Bates et al. make such a broad disclosure and that such a conclusion is in error.

Summary

For the reasons stated above, it is submitted that the final rejection of claims 1 and 4-12 should be reversed.

Payment of $540 for the required fee under 37 CFR §41.20(b)(2) is charged to our deposit account No. 08-3040. Please charge any deficiency in the fee submitted for this brief to our deposit account 08-3040.

Respectfully submitted,
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Enclosures:

(a) appendix with copy of claims on appeal

CLAIMS APPENDIX

COPY OF CLAIMS INVOLVED IN THE APPEAL

Claim 1 (previously presented): A sputtering target that is a perovskite oxide represented by the chemical formula of $Ra_{1-x}A_xBO_{3-\alpha}$, wherein Ra represents an element selected from the group consisting of Y, Sc and lanthanide elements; A represents Ca, Mg, Ba or Sr; B represents Mn; and $0<x\leq0.5$, and wherein the target has a relative density of 95% or more, an average crystal grain size of 100μm or less, a resistivity of 10Ωcm or less, and a purity of 3N or more.

Claims 2-3 (canceled).

Claim 4 (previously presented): A sputtering target according to claim 1, wherein A represents Mg.

Claim 5 (previously presented): A sputtering target according to claim 1, wherein A represents Ba.

Claim 6 (previously presented): A sputtering target according to claim 1, wherein Ra represents Sc.

Claim 7 (previously presented): A sputtering target according to claim 1, wherein Ra represents Ce, Pr, Nd, Sm, Eu, Gd, or Dy.

Claim 8 (previously presented): A sputtering target according to claim 1, wherein the resistivity of the sputtering target is 2Ωcm or less.

Claim 9 (previously presented): A sputtering target according to claim 8, wherein the relative density of the sputtering target is 98.4% or more

Claim 10 (previously presented): A sputtering target according to claim 9, wherein the average crystal grain size of the sputtering target is 50μm or less.

Claim 11 (previously presented): A sputtering target, comprising:

a sintered body sputtering target consisting of a perovskite oxide;

said perovskite oxide represented by the chemical formula of $Ra_{1-x}A_xMnO_{3-\alpha}$,

wherein Ra is an element selected from the group consisting of Sc, Ce, Pr, Nd, Sm, Eu, Gd and Dy; wherein A is Ca, Mg, Ba or Sr; and wherein $0<x\leq0.5$; and

said sputtering target having a relative density of 95% or more, an average crystal grain size of 100μm or less, a resistivity of 10Ωcm or less, and a purity of 3N or more.

Claim 12 (previously presented): A sputtering target according to claim 11, wherein said resistivity is 2Ωcm or less, said relative density is 98.4% or more, and said average crystal grain size is 50μm or less.

EVIDENCE APPENDIX - none

RELATED PROCEEDING APPENDIX - none